AWB Wheat Quality Fact Sheet
Stained Grain

AWB Receival Standards

According to the AWB Wheat Receival Standards, Stained Grain is defined as "a grain defect caused by either exposure to wet and damp conditions during the growth and maturation phases or a stress-related biochemical reaction, which causes individual grains to become visually discoloured. The definition includes kernels that display the following:

1. A distinct dark brown to black discolouration on the germ end that, in severe cases, may progress to other parts of the grain such as the crease. These grains are commonly referred to as Black Point or Black Tip.

2. A light grey to black mould-like discolouration that usually extends from the brush end of the grain, but does not cover more than 50 percent of the entire grain surface. Kernels with greater than 50 percent of a mould-like discolouration are to be classified under Field Fungi Affected Grains.

Grains that exhibit small dots covering less than approximately 5 percent of the surface area of the kernel (ie. a small proportion) are not to be classified as Stained Grains and are otherwise whole sound grains.

Photographic standards have been developed to assist classifiers in identifying Stained Grain.

Assessment of Stained Grain is conducted on wheat held above a 2mm screen following sieving. A maximum limit of 5% by count applies across all major milling grades. A tighter standard of 3% by count is applied to DR1, due the increased impact of staining on end products produced from durum semolina.

Off-grades such as AGP1 and AUH2 have a maximum Stained Grain tolerance of 15%. Grain exceeding this limit but less than 50% stained will be classified as Feed.

Nature

The precise nature and timing of environmental stresses that induce Stained Grains to develop are not fully understood at this time. However, it occurs more frequently and appears to be more severe in Queensland, northern NSW, northern Western Australia and the south coast of Western Australia.

Research suggests that Stained Grain occurs more regularly in larger sized wheat grains and high yielding wheat crops are generally the most seriously affected. This does not necessarily imply that larger grained cultivars are more susceptible, but it appears to be a direct relationship between the change in grain size/rate of change during grain filling.

A negative correlation between staining incidence and screenings (high staining – low screenings) has been found in many regional wheat trials in Queensland. This is also the case for regional trials carried out in Western Australia.

Researchers have found that high humidity alone can induce staining, but in the field, rainfall will invariably be involved.

Research has also indicated that the incidence of staining appears to increase with applied nitrogen.

Cause

Essentially there are two types of Stained Grains. The first is commonly referred to as Black Point and the second is a mould-like discolouration.

Researchers are still investigating the exact nature of Black Point, however, the current understanding is that Black Point is caused by the accumulation of an oxidised phenol compound resulting from a stress induced biochemical change. Peroxidase enzymes are responsible for browning in most damaged or stressed plant tissue and these enzymes have been found to be concentrated in the grain tissue that becomes discoloured.

The physiological mechanism that triggers the activation of the peroxidase enzymes is unknown. However, rainfall or high humidity around mid-grain filling and temperature are possibly involved.

The mould-like discolouration is caused by wet conditions prior to harvest that may be linked to particular farming practices. However the exact cause is unknown.

Impact

Discolouration of grain by staining impacts negatively on all markets, but particularly those where either the grain is processed whole, or the final sale transaction is agreed upon by visual inspection of a representative sample. For example, many consumers in the Middle East and Africa purchase their wheat as whole grain from a local market, therefore its appearance is of utmost importance. At the other extreme, processors in more developed markets have strict flour contamination thresholds which ultimately restricts the amount of Stained Grains that can be tolerated.

The impact upon the miller will vary according to the type of staining present. Staining on the germ end of the grain may be separated from the flour extracted. Any stained wheat germ fraction will have little saleable value due to the level of dark specks present. If staining is present in the crease, there is a greater potential for specks to appear in the flour extracted. Some mills are able to clean the flour produced via scouring, whist other mills will reduce their extraction rates in order to combat the problem. Either option obviously comes at a cost to the miller.

Stained Grain is a major quality problem for pasta products made from durum semolina. These products are more susceptible because the semolina milled from durum has a larger particle size compared to flour and is therefore more likely to retain the discolouration from Stained Grain.

What can be done?

Unfortunately there are no cost effective measures currently available to prevent the development of Stained Grain in the field.

Post harvest, the technology currently available does not allow growers to economically grade Stained Grain out of sound wheat. This is due to the fact that the majority of Stained Grains in a bulk will be relatively identical in size and weight to that of sound grain.

Wide variation in varietal susceptibility to Stained Grain has been documented. The mechanism and genetics of resistance in wheat varieties is currently being studied at the Queensland Department of Primary Industries.